REMARKS

Claims 1-18 and 37-54 have been cancelled. Claims 19-36 are pending in the present application. In the Office Action dated June 18, 2004, the Examiner rejected claims 19-23, 25, 28-32 and 34 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,198,684 to Sudo ("Sudo"). Claims 24, 26-27, 33 and 35-36 were also rejected under 35 U.S.C. 103(a) as being unpatentable over Sudo as applied to claims 19-20, 25, 28-29 and 34 above, and further in view of U.S. Patent No. 5,200,631 to Austin et al. ("Austin").

Embodiments Disclosed in the Present Application

The embodiments disclosed in the present application will now be discussed in comparison to the cited references. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the cited references do not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner appreciate important claim distinctions discussed thereafter.

An embodiment of the present application is illustrated in Figure 3. Referring to Figure 3, a chip 32 and a chip package 34 can transmit information to each other by using a set of converters capable of communicating with each other through the emission and reception of electromagnetic signals 42. Both the chip 32 and the chip package 34 have at least one such converter physically disposed on them. The chip 32 includes electronic circuitry 36 coupled to bonding pads 38 which, in turn, are coupled to first converters 40. Each first converter 40 receives a corresponding electric signal 41 from the circuitry 36 via the bonding pad 38, and converts the electric signal into an electromagnetic signal 42. The converter 40 then transmits the electromagnetic signal 42 to a corresponding second converter 44 located on the chip package 34. The second converter 44 receives the electromagnetic signal 42 and converts it to a corresponding electric signal 45 that is applied to an inner lead 46 of the chip package. The various converters employed may transmit and receive electromagnetic signals over a wide range of frequencies, including visible light and infrared frequencies. Thus, not having a direct physical connection between the chip 32 and the chip package 34 decreases the inductive and

capacitive effects commonly experienced with physical bonds, such as wire bonding, flip chip bonding, tape automated bonding, etc.

An embodiment disclosed in the present application directed to a memory device is shown in Figures 5 and 6. Referring to Figure 5, a memory device 99 including a semiconductor memory circuit 101 formed on a chip 100 and coupled to a chip package 102 through electromagnetic signals 104, 105, and 107 that include address, control, and data signals, respectively, for transferring data to and from the memory circuitry. The memory circuitry 101 includes an address decoder 106, a control circuit 108, and read/write circuitry 110. The address decoder 106, control circuit 108, and read/write circuitry 110 are all coupled to a memory cell array 112 and are also coupled to an address bus 114, a control bus 116, and a data bus 118 respectively.

The chip 100 includes an address converter 120 is configured to receive electromagnetic address signals 104 and converts these signals into corresponding electric address signals that are applied to the address decoder 106 over the address bus 114. A control converter 122 of the chip 100 is configured to receive electromagnetic control signals 105 and converts these signals into corresponding electric control signals that are applied to the control circuit 108 over the control bus 116. A read/write converter 124 of the chip 100 operates during write operations of the memory device 99 to receive electromagnetic data signals 107 and convert these signals into corresponding electric data signals that are then applied to the read/write circuitry 110 over the data bus 118. The read/write converter 124 also operates during read data transfers of the memory device 99 to receive electric data signals on the data bus 118 and convert these signals into corresponding electromagnetic data signals 107. A package address decoder 126 is mounted on the chip package 102 adjacent the address decoder 106, and receives electric address signals 133 and converts these signals into the electromagnetic address signals 104, and a package control converter 128 mounted on the chip package adjacent the control converter 122 operates in the same way to generate the electromagnetic control signals 105 in response to electric control signals 132 applied to the chip package. A package read/write converter 130 is mounted on the chip package 102 adjacent the converter 124 and operates during write operations to receive electric data signals 131 and generate the corresponding electromagnetic data signals 107. During read operations, the package read/write converter 130

receives the electromagnetic data signals 107 and generates the corresponding electric data signals 131. Thus, communication between the chip 100 and the chip package 102 is effected by transmitting electromagnetic data signals to and from the converters 120, 122, and 124 of the chip 100 with corresponding converters 126, 128, and 130 of the chip package 102.

Cited References

The Examiner has cited the Sudo reference. The Sudo reference is directed to optically communicating between a plurality of semiconductor assemblies. As shown in Figures 1 and 2, a substrate 10 includes a silicon substrate 20, a predetermined number of semiconductor chips 30 flip chip mounted thereto on a center portion of the silicon substrate 20. The semiconductor chips 30 include solder bumps 65 that are electrically connected to the silicon substrate 20. The substrate 10 also includes light transmit-receive elements 40A and 40B disposed at openings at openings 50 provided on both sides of the center portion of the silicon substrate 20. The elements 40A and 40B respectively comprise photodiode chips 42A and 42B, and semiconductor laser chips 44A and 44B. As shown in Figures 1 and 2, a plurality of substrates 10 may be spaced apart and stacked together so that light transmit-receive elements 40A and 40B may optically communicate with each other.

The Sudo reference discloses that the semiconductor chips 30 are conventionally flip chip bonded to the silicon substrate 20 to enable communication therebetween. The Sudo reference does not disclose or fairly suggest effecting communication between the semiconductor chips 30 and the silicon substrate 20 by converting electromagnetic signals to electric signals. In fact, the Sudo reference teaches the opposite by disclosing flip chip type bonding between the silicon substrate and the semiconductor chips 30 which does not require any conversion of electromagnetic signals to electric signals or vice versa. Furthermore, the Sudo reference does not disclose or fairly suggest that the semiconductor chip 30 include any memory circuitry.

The Examiner has also cited the Austin reference for disclosing encapsulating a chip on a chip package and transmitting signals in the infrared wavelength.

The Claims and Rejections

Turning now to the claims, the patentably distinct differences between the cited references and the claim language will be specifically pointed out. Claim 19 recites "[a] method of transferring data between a chip and a chip package, the chip including memory circuitry having control, address, and data signals, the chip further having bonding pads coupled to the memory circuitry to transfer control, address, and data signals to and from the circuitry, the chip package including a plurality of conductive components, the method comprising: receiving an electronic signal from a bonding pad of the chip; converting the electronic signal to an electromagnetic signal; transmitting the electromagnetic signal; receiving the electromagnetic signal; converting the received electromagnetic signal to an electronic signal; and applying the electronic signal to a conductive component of the chip package."

As amended, the body of claim 19 specifically refers to "receiving an electronic signal from a bonding pad of the chip." As required by the limitations of the preamble of claim 19, the chip includes "memory circuitry having control, address, and data signals" that is not disclosed or fairly suggested by the Sudo reference. Furthermore, the Sudo reference does not disclose or fairly suggest receiving an electronic signal from a chip disposed on a chip package, converting the electronic signal to an electromagnetic signal, transmitting the electromagnetic signal, receiving the electromagnetic signal, converting the electromagnetic signal to an electronic signal, and applying the electronic signal to the chip package. The Sudo reference teaches away by effecting communication between the silicon substrate 20 and the semiconductor chips 30 disposed thereon by conventional flip chip type bonding. Therefore, presently amended claim 19 is allowable over the Sudo reference. Claims depending from claim 19 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

Claim 28 recites "[a] method of transferring data between a chip and a chip package, the chip including memory circuitry having control, address, and data signals, the chip further having bonding pads coupled to the memory circuitry to transfer control, address, and data signals to and from the circuitry, the chip package including a plurality of conductive components, the method comprising: receiving an electronic signal from a conductive component of the plurality of conductive components; converting the electronic signal to an

electromagnetic signal; transmitting the electromagnetic signal; receiving the electromagnetic signal; converting the received electromagnetic signal to an electronic signal; and applying the electronic signal to a bonding pad of the chip."

Claim 28 specifically refers to "applying the electronic signal to a bonding pad of the chip." As required by the limitations of the preamble of claim 28, the chip further includes "memory circuitry having control, address, and data signals" that is not disclosed or fairly suggested by the Sudo reference. Furthermore, the Sudo reference does not disclose or fairly suggest receiving an electronic signal from a chip package having a chip disposed thereon, converting the electronic signal to an electromagnetic signal, transmitting the electromagnetic signal, receiving the electromagnetic signal, converting the electromagnetic signal to an electronic signal, and applying the electronic signal to the chip. The Sudo reference teaches away by effecting communication between the silicon substrate 20 and the semiconductor chips 30 disposed thereon by conventional flip chip type bonding. Therefore, presently amended claim 28 is allowable over the Sudo reference. Claims depending from claim 28 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

All of the claims remaining in the application (claims 19-36) are now clearly allowable. Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,

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